ZooKeys 1025: 1–19 (2021)
doi: 10.3897/zookeys.1025.56780
https://zookeys.pensoft.net

RESEARCH ARTICLE

A peer-reviewed open-access journal
ZooKeys
Launched to accelerate biodiversity research

A new species of the genus *Arria* Stål, 1877 (Mantodea, Haaniidae) from China with notes on the tribe Arriini Giglio-Tos, 1919

Ying-jian Wang[1,2,3], Lin Yang[1,2,3], Fei Ye[4], Xiang-sheng Chen[1,2,3]

1 *Institute of Entomology, Guizhou University, Guiyang, Guizhou, 550025, China* **2** *The Provincial Special Key Laboratory for Development and Utilization of Insect Resources of Guizhou, Guizhou University, Guiyang, Guizhou, 550025, China* **3** *Guizhou Key Laboratory for Plant Pest Management of Mountainous Region, Guizhou University, Guiyang, Guizhou, 550025, China* **4** *School of life sciences, Sun Yat-sen University, Guangzhou, Guangdong, 510275, China*

Corresponding author: Xiang-Sheng Chen (chenxs3218@163.com)

Academic editor: Fred Legendre | Received 21 July 2020 | Accepted 12 February 2021 | Published 18 March 2021

http://zoobank.org/0E2D3978-11A1-43F6-8D42-20BA15C44DC1

Citation: Wang Y-j, Yang L, Ye F, Chen X-s (2021) A new species of the genus *Arria* Stål, 1877 (Mantodea, Haaniidae) from China with notes on the tribe Arriini Giglio-Tos, 1919. ZooKeys 1025: 1–19. https://doi.org/10.3897/zookeys.1025.56780

Abstract

A new species of the praying mantis genus *Arria* Stål, *Arria pura* **sp. nov.** from southwest China is described and illustrated. An overview, comparison, and distribution data of this tribe are given. A new synonym is created: *Sinomiopteryx yunnanensis* Xu, 2007 is a junior synonym of *Arria pallida* (Zhang, 1987). One new combination *Arria brevifrons* (Wang, 1991) **comb. nov.** (from *Sinomiopteryx* Tinkham), is proposed.

Keywords

Arriini, Cernomantodea, genitalia, Oriental Region, praying mantis, taxonomy

Introduction

The tribe Arriini Giglio-Tos, 1919 (Mantodea, Haaniidae) comprises two genera, *Arria* Stål, 1877 and *Sinomiopteryx* Tinkham, 1937 (Schwarz and Roy 2019). The genus *Arria* was established by Stål (1877) based on the type species *A. cinctipes* Stål, 1877 from India. The other genus *Sinomiopteryx* was established by Tinkham (1937) based on the type species *S. grahami* Tinkham, 1937 from China. Recently, Schwarz and

Copyright *Ying-jian Wang et al.* This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Roy (2018) proposed that *Palaeothespis* Tinkham, 1937 and *Pseudothespis* Mukherjee, 1995 are junior synonyms of *Arria*. So far, the number of species in the genus *Arria* and *Sinomiopteryx* has changed from six to eight and four to two, respectively, including the new species, new synonym and new combination (Xu 2007; Schwarz and Roy 2018; Otte et al. 2020).

The species of Arriini are quite similar in appearance and there are few previous descriptions and illustrations of male genitalia. In this paper, during a study of the external morphology and male genitalia of Arriini, we found that *Arria* and *Sinomiopteryx* can be easily distinguished by male genitalia and other valuable appearance features, which are also provided to help distinguish the two genera.

Material and methods

Specimens were collected by sweeping net. The tip of the abdomen was separated and macerated in 10% water solution of KOH for about 12 hours, then washed in water and absolute ethanol. The terminalia were isolated into supra-anal and subgenital parts, the phallomeres were separated into left phallomere, ventral phallomere and right phallomere without overlapping, then all parts were preserved in glycerine in a microvial pinned with the specimen. Some wings were removed and mounted on a slide provided with the data of the specimen. External morphology and male genitalia were observed using a Leica M125 stereomicroscope. Photographs of phallomeres, terminalia and wings were taken with Nikon SMZ25, and photographs of the mounted specimens were taken with Canon EOS-70D digital camera with a Canon 100 mm Macro EF Lens or a Laowa 60 mm Macro Lens. Photo stacks were created using Helicon focus 6.0.18. Figures were processed with Adobe Photoshop CS6. Measurements were collected with the Keyence VHX-1000 system using the live measurement mode. Numeric patterns of the discoidal spines: The numbers (from left to right) represent the position (proximal to distal). Their value is representative of their respective length relation to the other spines with 1 being the shortest and 4 being the longest spine. Identical values represent equally long spines (Wieland 2013). L/W ratio of forewing means length to max width ratio of forewing. The classification system follows Schwarz and Roy (2019). Terminology and abbreviations follow Brannoch et al. (2017), for genitalia, we follow Schwarz and Roy (2019). Measurements follow Brannoch et al. (2017), but head length includes the labrum, foretibia length was from the base to the apex of the tibial spur, for apterous females the total length was from the vertex of the head to the posterior tip of the abdomen. The distribution map was created in SimpleMappr (Shorthouse 2010). Examined specimens were deposited in the following collections:

NFU Nanjing Forestry University, Nanjing, China;
SEM Shanghai Entomological Museum, CAS, Shanghai, China.

The type specimens of *Arria pura* sp. nov. are deposited in the Institute of Entomology, Guizhou University, Guiyang, Guizhou Province, China (IEGU).

Abbreviations

afa phalloid apophysis;
AvS anteroventral spine;
CuA anterior Cubitus;
DS discoidal spine;
fda main posterior lobe of right phallomere;
HT holotype;
L1 sclerite L1 of left phallomere;
L2 sclerite L2 of left phallomere;
L4 sclerite extending over most of the dorsal and ventral walls of left phallic;
L4A ventral sclerite of L4;
L4B dorsal sclerite of L4;
loa membranous lobe of left phallomere;
paa apical process of left phallomere;
pda primary distal process;
pia a process arising from the midlength to posterior right ventral wall of right phallomere, posterolateral to process pva;
pva a process arising from the midlength of the ventral wall of right phallomere, anteromesal to process pia;
PvS posteroventral spine;
PT paratype;
R1A dorsal sclerite of fda;
R1B sclerite on process pia and pva;
R3 anteriorly extending sclerite of right phallomere;
sdp secondary distal process;
sdpm median secondary distal process;
tl terminal lobe of ventral phallomere in *Arria*.

Checklist and distributions of species of Arriini

A. brevifrons (Wang, 1991), China (Zhejiang), comb. nov.
A. cinctipes Stål, 1877, India (Manipur).
A. leigongshanensis, (Ge & Chen, 2008), China (Guizhou, Yunnan).
A. meghalayensis, (Mukherjee, 1995), India (Meghalaya).
A. oreophila, (Tinkham, 1937), China (Sichuan).
A. pallida, (Zhang, 1987), China (Yunnan), *S. yunnanensis*, Xu 2007 is a junior synonym of *A. pallida.*
A. pura Wang & Chen, sp. nov., China (Guizhou).
A. sticta (Zhou & Shen, 1992), China (Guizhou, Hunan, Zhejiang).
S. grahami Tinkham, 1937, China (Sichuan).
S. guangxiensis Wang & Bi, 1991, China (Guangxi).

Taxonomy

Arriini Giglio-Tos, 1919

Arriini Giglio-Tos, 1919: 65; Schwarz and Roy 2019: 141.

Type genus. *Arria* Stål, 1877.
Distribution. China, India (Fig. 11).

Arria Stål, 1877

Arria Stål, 1877: 46; Tinkham 1937: 497; Zhang 1987: 239; Zhou and Shen 1992: 62; Wang and Bi 1991: 125; Wang 1993: 114; Mukherjee and Ghosh 1995: 251; Ehrmann 2002: 72, 259, 298; Xu 2007: 244; Ge and Chen 2008: 53; Schwarz and Roy 2018: 456; Schwarz and Roy 2019: 141.

Type species. *Arria cinctipes* Stål, 1877, original designation.

Diagnosis. Body medium and slender (Fig. 7), female stronger than male. Head narrowly transverse with juxtaocular bulges; compound eyes broadly oval, prominent; ocelli large in male (Fig. 8), minute in female. Lower frons transverse, 3.3–4.2 times as wide as high. Antennae filiform, long in male, much shorter in female. Forefemur slender, with 4 discoidal, 10–13 anteroventral and 4 posteroventral spines; foretibia with 7–9 anteroventral and 4–7 posteroventral spines. Pronotum short with supracoxal dilatation well marked, lateral margins with small denticles in male and strongly tuberculate in female. Forewing narrow with narrowly rounded apex, CuA branches no less than 5, L/W ratio is 4.3–5.5; fore margin with widely spaced cilia, hindwing with pointed apex, vein M with brunet band near the tip; both pairs of wings fully developed and exceeding the end of abdomen in male (Fig. 9); female apterous. Sclerite L4A approximately rhomboidal, males with terminal lobe (tl) of ventral phallomere fused to vla, protruding as a truncate lobe, close to sdpm ventrad; sdpm short; right phallomere with large pia and ear-shaped pva. Styli close to each other (Fig. 4).

Arria brevifrons (Wang & Bi, 1991), comb. nov.

Fig. 10A–D

Sinomiopteryx brevifrons Wang & Bi, 1991: 125; Wang 1993: 114.

Material examined. ***Holotype***, 1♂, China: Zhejiang Prov., Qingyuan County, Baishanzu, 1100 m, 14.X.1963, Gen-tao Jin leg., ID: 0800123 (SEM).

Remarks. This species was described and illustrated by Wang and Bi in 1991 based on one male specimen from Zhejiang. The ocelli are not closely grouped as in the males of *Sinomiopteryx*; forewings are narrow, L/W ratio is 4.8 with CuA_5, hindwings with pointed apex and brunet band of near apex of vein M. All features fall into the range of *Arria*. The specimen has had the abdomen removed, but we did not find the genitalia. According to the spots on the forelegs, *A. brevifrons* can be distinguished from *A. pallida* and *A. sticta*.

Arria cinctipes Stål, 1877

Arria cinctipes Stål, 1877: 46; Schwarz and Roy 2018: 456.

***Arria leigongshanensis* (Ge & Chen, 2008)**
Figs 4D–F, 9A, 10E–H

Palaeothespis leigongshanensis Ge & Chen, 2008: 53–58.

Material examined. ***Holotype***, 1♂, China: Guizhou Prov., Leigong Mountain National Natural Reserve, 13.IX.2005, Qiong-Zhang Song leg.; ***Paratype***, 1♀, same locality as for holotype, 14.IX.2005, Zhi-Jie Wang leg. (IEGU).

***Arria meghalayensis* (Mukherjee, 1995)**

Pseudothespis meghalayensis Mukherjee, 1995: 60; Schwarz and Roy 2018: 456.

***Arria oreophila* (Tinkham, 1937)**

Palaeothespis oreophila Tinkham, 1937: 497–499; Svenson 2014: 55–56.

Remarks. *Arria oreophila* was described and illustrated by Tinkham based on 1 male and 1 female from Sichuan, China. In Tinkham (1937), the foretibial consists of 13 anteroventral spines in males and 11 in females. But according to Svenson (2014), the anteroventral spines of the foretibia is R9/L8 in the male and 8 in the female. It falls into the range described for other species of *Arria*. *Arria oreophila* differs from others in both fore- and hindwings brownish, veins RP and M with two forks.

***Arria pallida* (Zhang, 1987)**
Figs 4G–I, 10I–L

Palaeothespis pallida Zhang, 1987: 239
Sinomiopteryx yunnanensis Xu, 2007: 244 syn. nov.

Material examined. ***Holotype***, 1♂, China: Yunnan Prov., Lushui County, 10.X.1980, Guo-zhong Zhang leg. (NFU); 2♂♂, Yunnan Prov., Fenshuiling National Natural Reserve, 19.V.2015, Yun-fei Wu and Jia-jia Wang leg. (IEGU).

Remarks. Xu (2007) described this species in *Sinomiopteryx* from Yunnan, China. The descriptions and illustrations for both external morphology and genitalia of *Sinomiopteryx yunnanensis* Xu, 2007 fall into the range presented for *Arria pallida* (Zhang, 1987), especially the significant differences of male genitalia between *Arria* and *Sinomiopteryx* (Figs 4A–L, 5A–F). Therefore, we consider *S. yunnanensis* Xu, 2007 as a junior synonym of *A. pallida* Zhang, 1987.

Figure 1. *Arria pura* sp. nov., dorsal habitus **A** male holotype **B** female paratype **C** posteroventral geniculars spines of male forefemur (not to scale). Scale bar: 10 mm.

Arria pura Wang & Chen, sp. nov.

http://zoobank.org/12C0F813-0717-4B2D-81C7-1E713062E2AE

Figs 1–3, 4A–C, 6

Type material. ***Holotype*:** ♂, China: Guizhou Province, Weining County, Jinzhong Town (26°42.34'N, 104°37.29'E), 2550 m, 17.VIII.2017, Ying-Jian Wang; ***Paratypes*:** 1♀, same data and locality as holotype (IEGU), PT1; 1♀, Guizhou Province, Weining County, Xueshan Town (27°04.04'N, 104°06.68'E), 2450 m, 2.IX.2019, Feng-E Li, PT2.

Description. Measurements are provided in Table 1.

Male. Small, slender (Figs 1A, 3).

Head (Fig. 2A). Triangular, about 1.4 times as wide as long. Vertex with pair of paramedian depressions, otherwise flat. Compound eyes oval and large, conspicuously projecting outside profile of head. Juxtaocular bulges present, extending to the dorsal edge of vertex. Ocelli large and elliptic, lateral paired ocelli larger. Antennae filiform, ciliated. Scapus cylinder-shaped, slightly depressed in the middle, approximate as length as width. Pedicellus almost as long as scapus yet narrower, goblet-space. Third antennomere about as long as pedicel. Fourth antennomere less than half of third length.

Table 1. *Arria pura* sp. nov., measurements of type specimens, in mm.

Measured structure	HT (male)	PT1(female) #1	PT2(female)
Head width	2.6	3.2	3.1
Head length	1.8	2.5	2.3
Lower frons width	1.0	1.2	1.2
Lower frons length	0.4	0.5	0.4
Body length	26.3	23.0	21.9
Pronotum length	5.3	6.1	5.7
Prozone length	2.1	2.4	2.3
Metazone length	3.2	3.7	3.4
Pronotum max. width	1.7	2.1	2.0
Forewing length	21.6	–	–
Forewing max. width	4.0	–	–
Forecoxa length	4.3	4.7	4.5
Forefemur length	5.3	5.6	5.3
Forefemur max. width	0.7	1.0	1.0
Foretibia length	2.8	3.2	3.1
Foretarsus length	4.0	3.0	2.8
Mesocoxa length	1.5	1.6	1.8
Mesofemur length	4.4	4.0	3.8
Mesotibia length	3.2	3.0	2.9
Mesotarsus length	2.9	2.4	2.2
Metacoxa length	1.8	1.8	1.8
Metafemur length	5.2	4.7	4.5
Metatibia length	5.6	4.8	4.4
Metatarsus length	4.3	3.5	3.1
Subgenital plate length	1.7	1.9	1.6
Subgenital plate width	1.4	3.5	3.2

Lower frons transverse, 4.2 times as wide as high, flat medially, with dorsal and lateral margins bordered by protruding ridge, ventral margin inconspicuous, dorsal margin obtuse-angled. Clypeus smooth, above of ventral margin with a transverse groove.

Prothorax (Fig. 2B). Short, 3.2 times as long as wide, metazone 1.5 times as long as prozone, lateral margins with small and few setiferous denticulations, middle carina present but feeble in prozone, behind supracoxal sulcus with pair of depressions, posterior margin with pair of paramedian bulges. Prosternum with middle carina posteriad supracoxal sulcus.

Cervix. No ventral cervical sclerite. Intercervical sclerite merged at middle, without torus intercervicalis. Postcervical plate and furcasternite flat.

Metathorax. With cyclopean ear of DK type.

Forelegs. Forecoxa longer than metazone with anterior lobes diverging, dorsal edge and ventral edge with 3–4 and 9–11 tubercules respectively, all tubercules with small seta (Fig. 2D); anterior and posterior surface of forecoxa mostly smooth. Forefemur (Fig. 2E) slender, with four posteroventral spines, almost as long as each other; four discoidal spines, numeric patterns: 1231, the fourth discoidal spines inclined toward apex strongly; eleven anteroventral spines, the resulting arrangement of the holotype being iIiIiIiIiiI; posteroventral genicular lobe with two spines arranged in a row and the small one near apex (Fig. 1C); anteroventral genicular lobe with a single spine; F = 4DS/11AvS/4PvS. Foretibia armament: six posteroventral spines, the apical two

Figure 2. *Arria pura* sp. nov., details of morphology **A–F** male **G–K** female **A, G** head, frontal view **B, H** pronotum, dorsal view **C** forewing, dorsal view **D, I** forecoxa, ventral view **E, J** fore- trochanter and femur, ventral view **F, K** foretibia, ventral view. Scale bars: 5 mm (**C**); 1 mm (**A, B, D–K**).

closes to each other; eight anteroventral spines, elongating distally; T = 8AvS/6PvS. Metatarsus 1.5 times as long as remaining tarsomeres combined.

Middle and hind legs. Long, cursorial. Meso- and metafemur apically without genicular spine. Meso- and metatibia apically with two spines. Middle 2 to 5 tarsomeres combined 1.6 times as long as middle metatarsus. Hind metatarsus slightly longer than remaining tarsomeres combined.

Wings (Fig. 2C). Fully developed, surpassing the end of abdomen. Forewing hyaline without spots, 5.4 times as long as width. Costal field reaches 4/5 of the forewing's length. Stigma elongated, inconspicuous.

Abdomen. Depressed dorsoventrally, coxosternite 9 (subgenital plate) (Fig. 4C) longer than wide, covered ventrally and laterally by numerous setae. Tergite 10 (supra-anal plate) (Fig. 4B) triangular. Cerci with approximate 12 cercomeres, difficult to distinguish from each other near the base, distal-most cercomere elongate.

Figure 3. Male last instar nymph of *A. pura* sp. nov. holotype, life habitus **A** dorsal view **B** lateral view. Photograph by Ying-Jian Wang.

Male genitalia (Fig. 4A). Sclerite L4A approximately rhomboidal, with strongly transverse terminal lobe (tl) on right side of distal process in ventral view. Distal process inclined dorsolaterally, at an angle of 100° relative to the plane of L4A. Sclerite L4B winebottle-shaped, slightly curved near base. Sclerite L2 with apical process paa strongly curved, almost parallel to L4B dorsally. Sclerite L1 elongated, afa sclerotized, covered by numerous small granules apically. Fda of right phallomere sclerotized by sclerite R1A densely covered by long setae. Sclerite R1A more or less triangular. Sclerite R3 drumstick-shaped; sclerotized processes very developed. Sclerite R1B with pia well sclerotized, process pva large, ear-shaped.

Coloration. General color brown. Vertex brown; juxtaocular bulges fuscous. Ocelli hyaline. Foretrochanter black ventrally, base anteroventral of forefemur black as well as base of tibial spur groove (Fig. 2E). All spines arising from forefemoral, foretibial and tibial spur fuscous apically. Meso- and metatibia light brown. Fore- and hindwings hyaline, light brown, apex and costal area of forewings brownish (Fig. 2C).

Female. Apterous (Fig. 1B).

Head (Fig. 2G). Triangular, about 1.3 times as wide as long. Compound eyes oval and large, obviously projecting outside profile of head. Juxtaocular bulges slightly exceeding dorsal margin of vertex. Ocelli smaller than male. Antennae much shorter than male. Lower front transverse 3.9 times as wide as long, dorsal and lateral margins depressed.

Prothorax (Fig. 2H). 3 times as long as wide, metazone 1.5 times as long as prozone. Lateral margin with more and stronger denticulations. Several tubercules present

Figure 4. Male genitalia (ventral view) and terminalia (dorsal view) of *Arria* spp. **A–C** *A. pura* sp. nov., holotype **D–F** *A. leigongshanensis* (Ge & Chen, 2008), holotype **G–I** *A. pallida* (Zhang, 1987) (IEGU: HAAP1) **J–L** *A.* sp.2 (IEGU: HAASP2-1). Scale bars: 1 mm.

Figure 5. Male genitalia (ventral view) and terminalia (dorsal view) of *Sinomiopteryx* spp. **A–C** *S. guangxiensis* Wang & Bi, 1991 (IEGU: HASG1) **D–F** *S.* sp.1 (IEGU: HASSP1-1) **G–I** *S.* sp.2 (IEGU: HASSP2-1). Scale bars: 1 mm.

on pronotum, especially prozone. The paramedian bulges near posterior margin more prominent. Carina on prosternum short.

Cervix. As in the male.

Metathorax. With cyclopean ear of DNK type.

Forelegs. Forecoxa longer than metazone with anterior lobes diverging, dorsal margin with 5–6 small tubercules, ventral edge with 13–15 smaller tubercules, all tubercules with small seta, anterior and posterior of forecoxa mostly smooth (Fig. 2I). Forfemur stronger than male; forefemoral armament with four posteroventral spines; four discoidal spines, numeric patterns: 1231, the fourth discoidal spine strongly inclined toward apex; anteroventral spines with the resulting arrange-

Figure 6. Ootheca of *Arria pura* sp. nov. **A** lateral view **B** dorsal view. Scale bar: 1 mm.

Figure 7. Comparition of Arriini spp., dorsal habitus **A** *A.* sp.1 (IEGU: HAASP1-1) **B** *S.* sp.1 (IEGU: HASSP1-1). Scale bar: 10 mm.

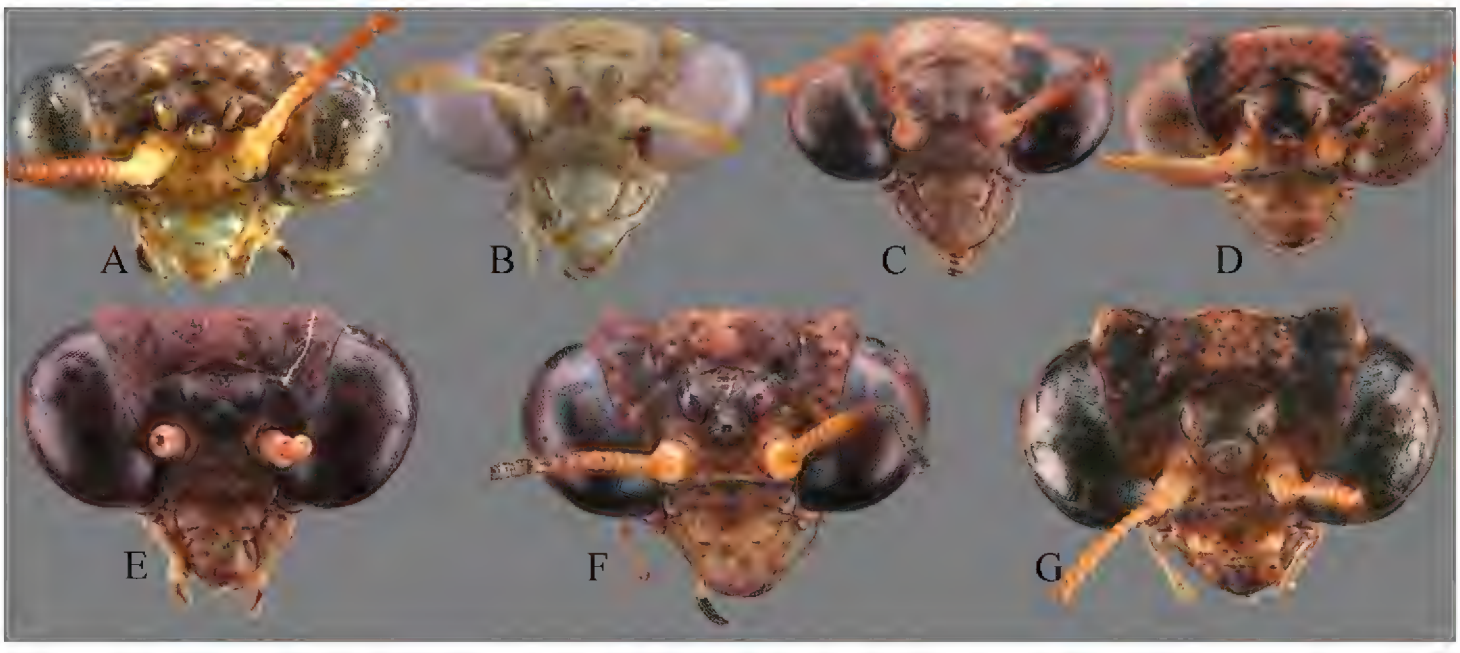

Figure 8. Comparison of Arriini spp., head, frontal view **A** *A. leigongshanensis*, holotype **B** *A. pallida* (IEGU: HAAP1) **C** *A.* sp.1 (IEGU: HAASP1-1) **D** *A.* sp.2 (IEGU: HAASP2-1) **E** *S. guangxiensis* (IEGU: HASG1) **F** *S.* sp. 1 ((IEGU: HASSP1-1) **G** *S.* sp. 2 (HASSP2-1). Not to scale.

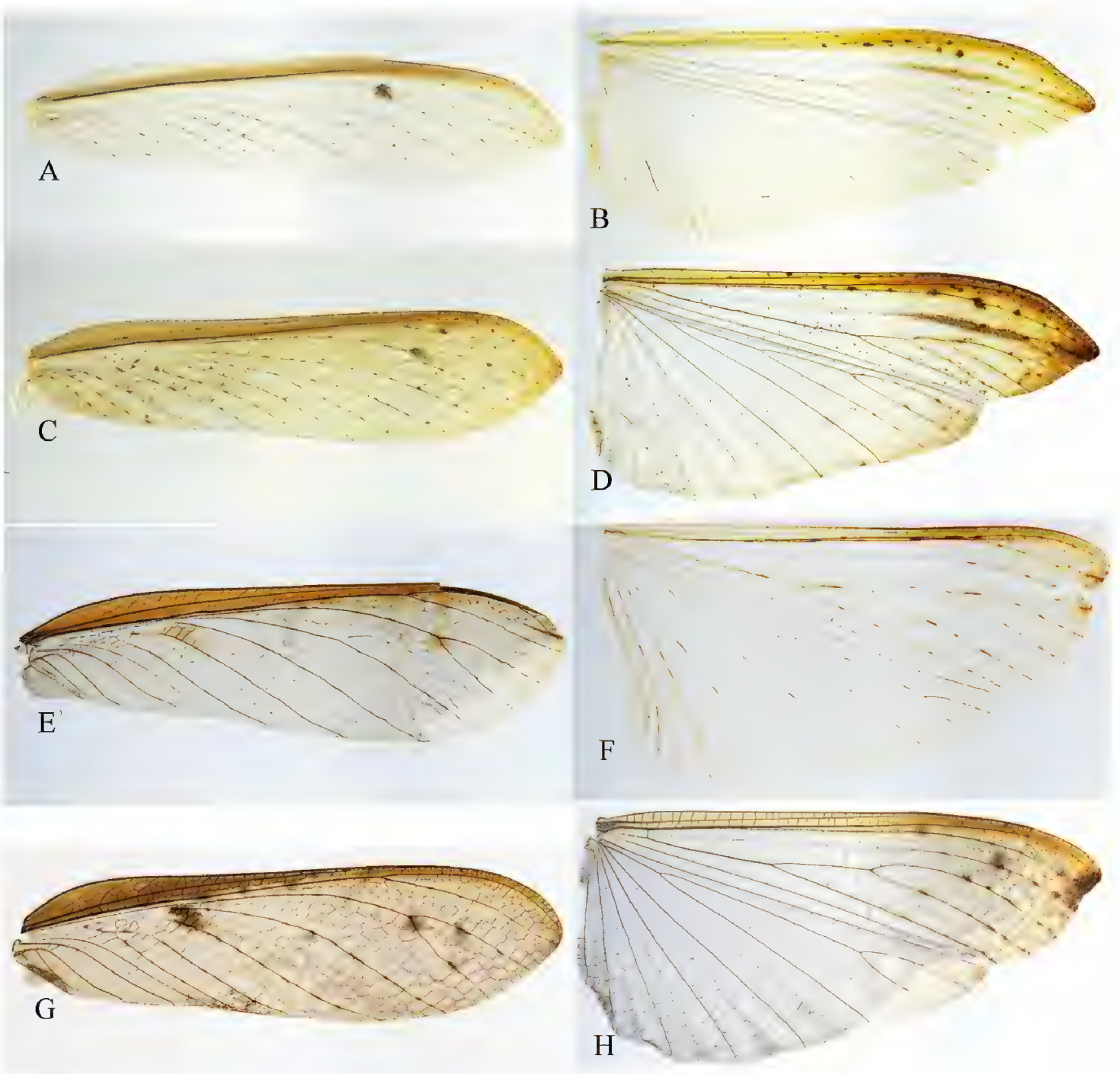

Figure 9. Comparison of Arriini spp., right fore- and hindwings, dorsal view **A, C, E, G** forewings **B, D–F** hindwings **A, B** *A.* sp.1 (IEGU: HAASP1-1) **C, D** *A.* sp.2 (IEGU: HAASP2-1) **E, F** *A.* sp.2 (IEGU: HAASP2-1) **G, H** *S.* sp.2 (HASSP2-1). Not to scale.

ment: iIiIiIiIiiI; F = 4DS/11AvS/4PvS; both genicular lobes with only one spine. Foretibial armament consisting of 5 posteroventral and 7–8 anteroventral spines; T = 7–8AvS/5PvS.

Middle and hind legs. As in the male.

Wings. Apterous, wing pads fused to meso- and metathorax (Fig 1B).

Abdomen. Much wider than male, fusiform. Posterior margin of 1–9 tergites and 2–6 coxosternites with several small tubercles. The lobes on the middle of tergites inconspicuous. Tergite 10 trapezoidal, longer than wide. Cerci short, slightly surpassing tergite 10.

Coloration. General color brown (Fig. 1B). Vertex and juxtaocular bulge yellowish-brown (Fig. 2G). Ocelli hyaline. Clypeus with several dark spots. Tubercules on pronotum dark brown as well as denticulations on lateral margin of pronotum

(Fig. 2H). Anterior surface of forecoxa with 3–4 black spots near ventral margin (Fig. 2I). Foretrochanter black ventrally. Anteroventral base of forefemur, base of tibial spur groove and the middle of them black; anteroventral base of forefemur and base of tibial spur groove black, with another irregular black spots near one-fourth basal of anteroventral margin (Fig. 2J). All spines arsing from forefemoral, foretibial and tibial spur fuscous apically. Meso- and metatibia light brown. The tubercles on abdomen fuscous (Fig. 1B).

Ootheca (Fig. 6). Small, rectangular, mostly trapezoid in cross-section. Residual process long, aciculiform. External wall generally russet brown, with many bubble-like structures embedded, without external coating. Ventral surface attached to complanate substrates, such as surface of leaves. Emergence area raised, openings inconspicuous. Measurements (in mm): length (without residual process), 6.1; length of residual process, 3.1; width, 3.8; thickest girth, 25.3; length of emergence area, 5.7; width of emergence area, 1.8.

Distribution. China (Guizhou) (Fig. 11).

Etymology. The specific name is derived from the Latin words "*pura*" (meaning pure) which refers to the forewing without any spots.

Remarks. The new male species is much smaller than all other known species of *Arria*. Additionally, it can be distinguished from *A. brevifrons*, *A. cinctipes*, *A. leigongshanensis*, *A. pallida* and *A. sticta* by tegmina without any spots. *Arria pura* also differs from *A. oreophila* in having less forked RP and M.

Arria sp. 1

Material examined. China: 3♂♂1♀, Guizhou Prov., Dashahe National Natural Reserve, 26.V.2004, Xiang-Sheng Chen and De-Yan Ge leg. (IEGU); 3♂♂, Hunan Prov., Xiaoxi National Natural Reserve, 15–21.VIII.2016, Ying-jian Wang leg. (IEGU); 5♂♂3♀♀, Guizhou Prov., Leigongshan National Natural Reserve, 17–20.VIII.2019, Ying-jian Wang leg. (IEGU).

Arria sticta (Zhou & Shen, 1992)

Palaeothespis sticta Zhou & Shen, 1992: 62–63.

Remarks. The holotype is probably lost, as we did not find it in the Zhejiang Museum of Natural History where the author used to work. *Arria sticta* is similar to *A. pallida* but differs from the latter in that a dark stripe is located along the anteroventral base to the first discoidal spine of forefemur; with three dark spots on the ventral surface of forefemur.

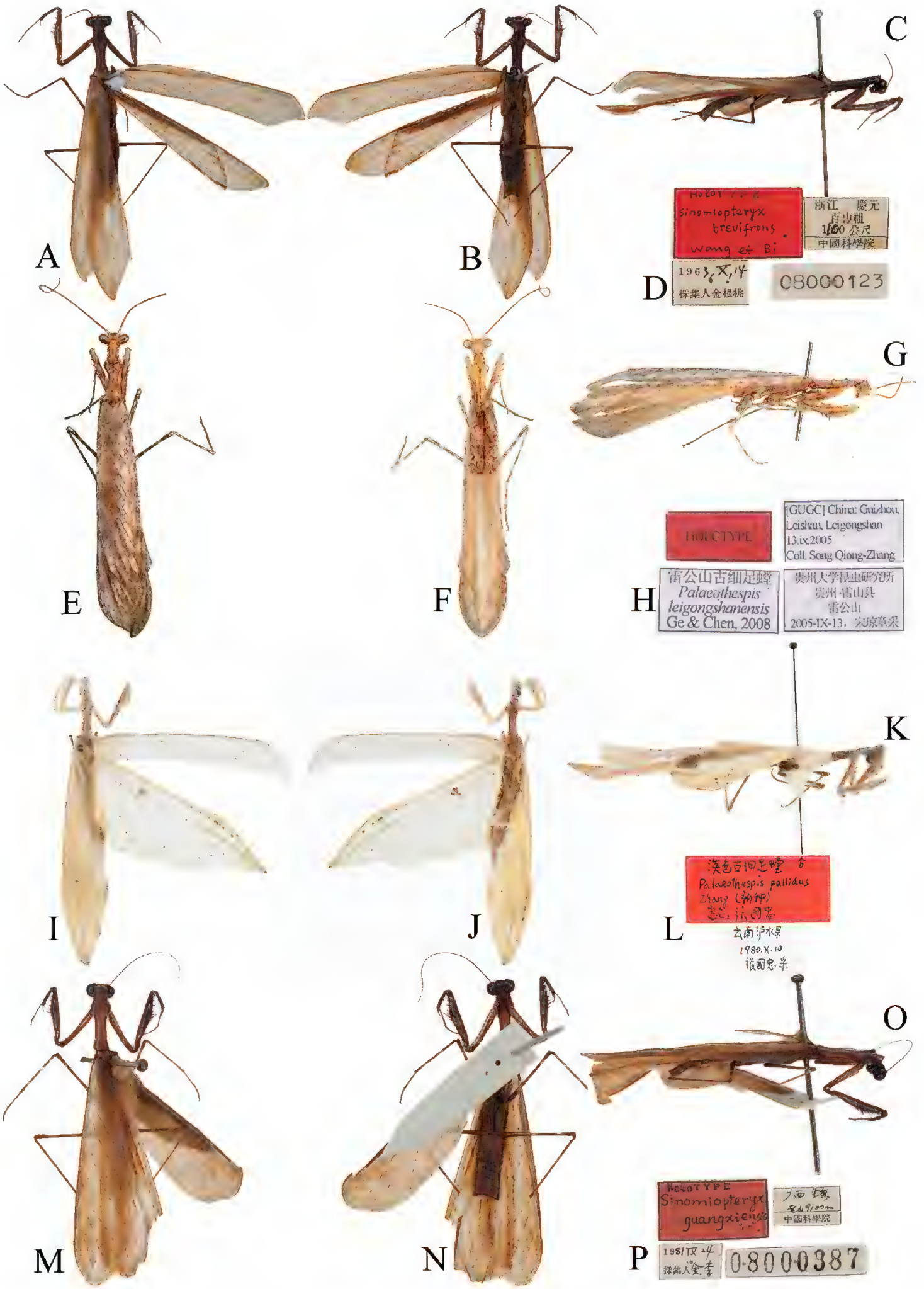

Figure 10. Holotypes of Arriini spp. **A, E, I, M** dorsal habitus **B, F, J, N** ventral habitus **C, G, K, O** lateral habitus **D, H, L, P** labels **A–D** *A. brevifrons* comb. nov. (SEM) **E–H** *A. leigongshanensis* (IEGU) **I–L** *A. pallida* (NFU) M-P *S. guangxiensis* (SEM). Not to scale.

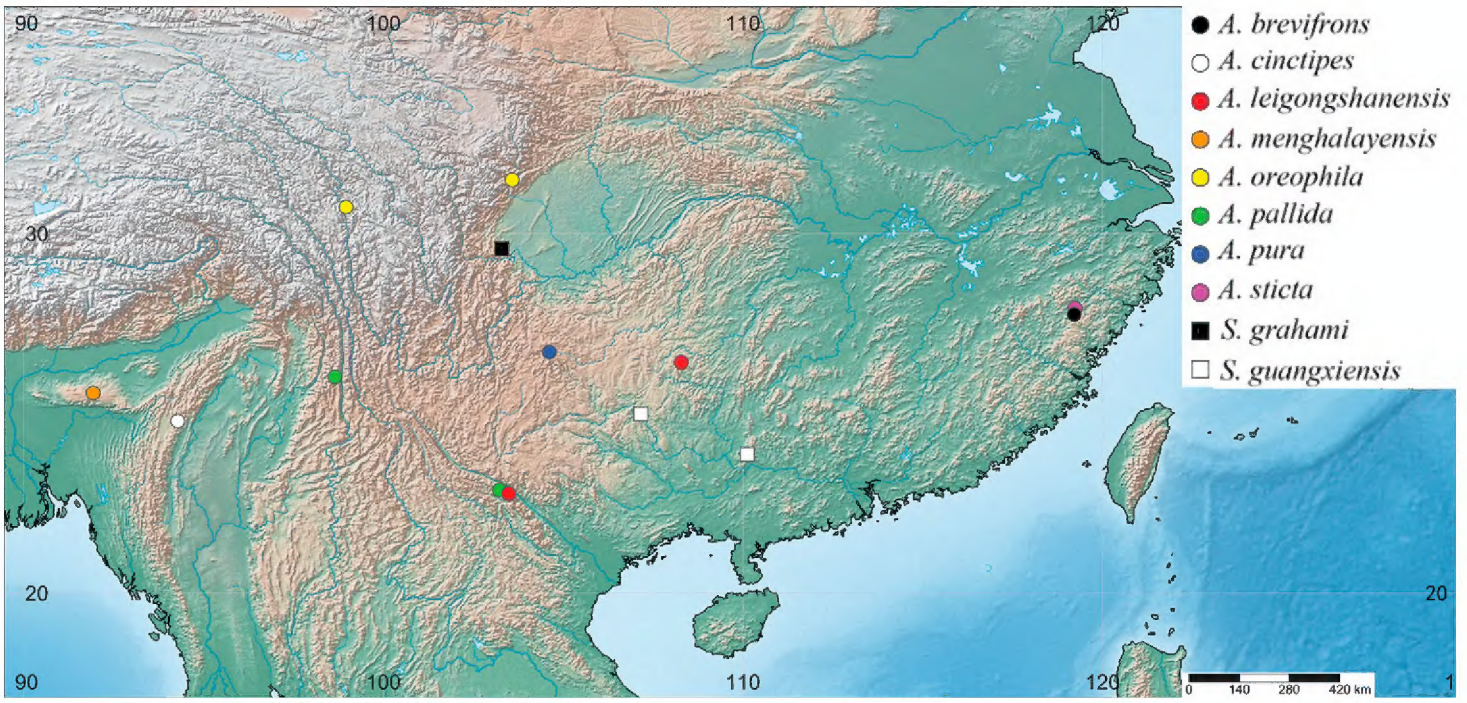

Figure 11. Arriini Giglio-Tos, 1919, distribution map.

Sinomiopteryx Tikham, 1937

Sinomiopteryx Tikham, 1937: 495; Wang and Bi 1991: 126; Wang 1993: 111; Ehrmann 2002: 319.

Type species. *Sinomiopteryx grahami* Tinkham, 1937, original designation.

Diagnosis. Body medium and slender (Fig. 7). Head narrowly transverse with prominent juxtaocular bulges; compound eyes broadly oval, prominent; Ocelli very large closely grouped in the male (Fig. 8E–G), minute in the female. Lower frons narrowly transverse. Antennae filiform, long in male, much shorter in female. Forefemur of males wider than in *Arria*, with 4 discoidal, 11–13 anteroventral and 4 posteroventral spines; foretibia with 8–10 anteroventral and 5–6 posteroventral spines. Pronotum short with supracoxal dilatation well marked, sparsely granulate, lateral margins with sparsely and strongly denticulate. Forewing broader than *Arria*, with rounded apex, CuA branches no more than 4, L/W ratio is 3.3–3.7, fore margin clothed with dense cilia; hindwing with truncate apex; both pairs of wings fully developed and exceeding the end of abdomen in male (Fig. 9E–H); female apterous. Sclerite L4A approximately rhomboidal, sdp thick with tip granulated, no terminal lobe (tl), right phallomere with large pia and pva. Styli far apart from each other.

Sinomiopteryx grahami Tinkham, 1937

Sinomiopteryx grahami Tinkham, 1937: 495; Wang and Bi 1991: 126; Wang 1993: 112; Ehrmann 2002: 319; Svenson 2014: 70.

Remarks. Tinkham (1937) erected *Sinomiopteryx* with this male species, collected from Szechwan, Mt. Omei, Baian-Kara-Ula Range (China, Sichuan Prov., Mountain

Emei), illustrated both male and female lateral habitus, and left tegmen in dorsal view. Wang and Bi (1991) and Wang (1993) illustrated the genitalia for *S. graham,* but it may have been mistaken.

Sinomiopteryx guangxiensis Wang & Bi, 1991

Sinomiopteryx guangxiensis Wang & Bi, 1991: 126; Wang 1993: 112; Ehrmann 2002: 319.

Material examined. ***Holotype***, 1♂, China: Guangxi Prov., Jinxiu county, Laoshan, 24.IX.1981, Gen-tao Jin & Fu-liang Li leg. ID: 08000387 (SEM); 1♂, Guangxi Prov., Tian'e County, Longtan Nature Reserve, 18.VII.2015, Ying-jian Wang leg. (IEGU).

Remarks. This species was described and illustrated by Wang and Bi in 1991 based on one male specimen from Guangxi, the holotype has had the abdomen removed, but we did not find the genitalia. Fortunately, we collected a male from Guangxi, and it perfectly fits with *S. guangxiensis*, and can be used as accurate comparative material.

Sinomiopteryx sp. 1

Material examined. China: 2♂, Guizhou Prov., Ziyun County, Xiaochuandong, 15.XI.2015, Ying-jian Wang leg. (IEGU); 1♂, Guizhou Prov., Ziyun County, Xiaochuandong, 15.IX.2016, Ying-jian Wang leg. (IEGU); 1♂, Guizhou Prov., Ziyun County, Xiaochuandong, 21.X.2019, Ying-jian Wang leg. (IEGU); 1♂, Guizhou prov., Duyun city, Doupengshan, 22.IX.2016, Ying-jian Wang leg. (IEGU); Hunan Prov., Xiaoxi National Natural Reserve, 20.VIII.2016, Ying-jian Wang leg. (IEGU).

Sinomiopteryx sp. 2

Material examined. China: 1♂, Yunnan Prov., Maguan County, Gulinqing town, 23.VIII.2020, Xiang-jin Liu leg. (IEGU).

Discussion

Arria is superficially similar to *Sinomiopteryx*, but differs substantively in details. *Arria* can be distinguished from the latter by the following characters: (1) ventral phallomere with terminal lobe (tl) (*Sinomiopteryx* without pl); (2) styli close to each other (styli further apart in *Sinomiopteryx*) (Figs 4–5); (3) forewings narrower, L/W ratio is 4.3–5.5, CuA with five branches or more (forewings wide, L/W ratio is 3.3–3.7, CuA with four branches or less in *Sinomiopteryx*) (Fig. 9). The ocelli characters seem unstable in *Arria*, especially in *A. leigongshanensis*, they look as in *Sinomiopteryx*, but

they are very large and grouped in *Sinomiopteryx* (Fig. 8). Nevertheless, identification of species may be difficult because original species descriptions are inadequate in that many features are not evaluated and included, especially the male genitalia. Besides, most females of Arriini are undescribed and difficult to distinguish from each other, unless both male and female are collected at the same time or DNA barcoding is performed. Further fieldwork is needed to uncover specimens of the rare tribe, finally allowing for its better characterization.

Acknowledgements

We are indebted to Christian J. Schwarz (Ruhr University Bochum, Germany) for providing important literature and suggestions on earlier drafts of this manuscript. We are grateful to Cuiqing Gao (Nanjing Forestry University), Liwei Liu (Zhejiang Museum of Natural History), Weibing Zhu (Shanghai Entomological Museum), Floyd W. Shockley (National Museum of Natural History, Smithsonian Institution), Gavin Svenson (Cleveland Museum of Natural History) for helping us check the types. This work was supported by the Science and technology support program of Guizhou Province (No. 20201Y129), the Program of Excellent Innovation Talents, Guizhou Province (No. 20154021) and the Program of Science and Technology Innovation Talents Team, Guizhou Province (No. 20144001).

References

Brannoch SK, Wieland F, Rivera J, Klass KD, Béthoux O, Svenson GJ (2017) Manual of praying mantis morphology, nomenclature, and practices (Insecta, Mantodea). ZooKeys 696(3): 1–100. https://doi.org/10.3897/zookeys.696.12542

Ehrmann R (2002) Mantodea. Gottesanbeterinnen der Welt. Münster, Natur und Tier-Verlag Gmb H, 72, 259, 298.

Ge DY, Chen XS (2008) Review of the genus *Palaeothespis* Tinkham, 1937 (Mantodea: Thespidae), with description of one new species. Zootaxa 1716: 53–58. https://doi.org/10.11646/zootaxa.1716.1.5

Giglio-Tos E (1919) Saggio di una nuova classificazione dei Mantidi. Bullettino della Società Entomologica Italiana 49: 50–87.

Mukherjee TK, Hazra AK, Ghosh AK (1995) The mantid fauna of India (Insecta: Mantodea). Oriental Insects 29: 185–358. https://doi.org/10.1080/00305316.1995.10433744

Otte D, Lauren S, Martin BD (2020) Mantodea Species File Online. Version 5.0/5.0. http://Mantodea.SpeciesFile.org [Accessed 10 Jun 2020]

Schwarz CJ, Roy R (2018) Some taxonomic and nomenclatural changes in Mantodea (Insecta: Dictyoptera). Bulletin de la Société entomologique de France 123(4): 456–456. https://doi.org/10.32475/bsef_1990

Schwarz CJ, Roy R (2019) The systematics of Mantodea revisited: an updated classification incorporating multiple data sources (Insecta: Dictyoptera). Annales de la Société entomologique de France (N.S.) 55(2): 141–141. https://doi.org/10.1080/00379271.2018.1556567

Shorthouse DP (2010) SimpleMappr, an online tool to produce publication-quality point maps. Accessed 23 November 2019. http://www.simplemappr.net

Stål C (1877) Systema Mantodeorum. Essai d'une systématisation nouvelle des Mantodées. Bihang till Kongliga Svenska Vetenskaps Akademiens Handlingar 4(10): 1–91.

Svenson GJ (2014) The type material of Mantodea (praying mantises) deposited in the National Museum of Natural History, Smithsonian Institution, USA. Zookeys 433: 31–75. https://doi.org/10.3897/zookeys.433.7054

Tinkham ER (1937) Studies in Chinese Mantidae (Orthoptera). Lingnan Science Journal 16(3): 495–499.

Wang TQ (1993) Synopsis on the classification of Mantodea from China. Shanghai: Science and Technology publication of Shanghai, 110–116.

Wang TQ, Bi DY (1991) Two new species of *Sinomiopteryx* Tinkham, 1937 (Mantodea: Mantidae). Contributions from Shanghai Institute of Entomology Vol. 10: 125–128.

Wieland F (2013) The phylogenetic system of Mantodea (Insecta: Dictyoptera) Species, Phylogeny and Evolution. Universitätsverlag Göttingen (SPE) 3(1): 3–222. https://doi.org/10.17875/gup2013-711

Xu JS (2007) A new species of the genus *Sinomiopteryx* Tinkham, 1937(Mantodea: Mantidae) from Yunnan. Entomotaxonomia 29(4): 244–246.

Zhang GZ (1987) A new species of the genus *Palaeothespis* Tinkham from China. Entomotaxonomia 9(3): 239–241.

Zhou WB, Shen SG (1992) Study of Mantodea fauna in Zhejiang and Yunnan provinces and two new species. Journal of Shanghai Teachers University (Natural Science) 21(1): 62–68.

Zhu XY, Wu C, Yuan Q (2012) Mantodea in China. Xiyuan Publishing House, Beijing, 331 pp.